formed from a pair of arms **108** that extend along the Y dimension of FIG. **4** and a second dipole formed from a pair of arms **108** that extend along the perpendicular X dimension of FIG. **4**). Perpendicular dipole elements may be used to provide antenna **40** with the ability to handle antenna signals with orthogonal polarizations.

[0036] Patch antenna structures may also be used for implementing antenna **40** (e.g., antennas **40**A and/or antennas **40**B of FIG. **1**). An illustrative patch antenna is shown in FIG. **5**. As shown in FIG. **5**, patch antenna **40** may have a patch antenna resonating element such as patch **110** that is separated from a ground plane structure such as ground **112**. Antenna patch resonating element **110** and ground **112** may be formed from metal foil, machined metal structures, metal traces on a printed circuit or a molded plastic carrier, electronic device housing structures, or other conductive structures in an electronic device such as device **10**A or **10**B **10**.

[0037] Antenna patch resonating element **110** may lie within a plane such as the X-Y plane of FIG. **5**. Ground **112** may line within a plane that is parallel to the plane of antenna patch resonating element (patch) **110**. Patch **110** and ground **112** may therefore lie in separate parallel planes that are separated by a distance H. Conductive path **114** may be used to couple terminal **98'** to terminal **98**. Antenna **40** may be fed using a transmission line with positive conductor coupled to terminal **98'** and thus terminal **98** and with a ground conductor coupled to terminal **100**. Other feeding arrangements may be used if desired. Moreover, patch **100** and ground **112** may have different shapes and orientations (e.g., planar shapes, curved patch shapes, patch element shapes with non-rectangular outlines, shapes with straight edges such as squares, shapes with curved edges such as ovals and circles, shapes with combinations of curved and straight edges, etc.).

[0038] A side view of a patch antenna such as patch antenna **40** of FIG. **5** is shown in FIG. **6**. As shown in FIG. **6**, antenna **40** may be fed using an antenna feed (with terminals **98** and **100**) that is coupled to a transmission line such as transmission line **92** (e.g., a signal path that forms one of circuit branches **102**A of FIG. **1** or one of circuit branches **102**B of FIG. **1**). Patch element **110** of antenna **40** may lie in a plane parallel to the X-Y plane of FIG. **6** and the surface of the structures that form ground **112** (i.e., ground **112**) may line in a plane that is separated by vertical distance H from the plane of element **110**. With the illustrative feeding arrangement of FIG. **6**, ground conductor **96** of transmission line **92** is coupled to antenna feed terminal **100** on ground **112** and positive conductor **94** of transmission line **92** is coupled to antenna feed terminal **98** via an opening in ground **112** and conductive path **114** (which may be an extended portion of conductor **94**). Other feeding arrangements may be used if desired (e.g., feeding arrangements in which a microstrip transmission line in a printed circuit or other transmission line that lies in a plane parallel to the X-Y plane is coupled to terminals **98** and **100**, etc.).

[0039] To enhance the frequency coverage and polarizations handled by patch antenna **40**, antenna **40** may be provided with multiple feeds. An illustrative patch antenna with multiple feeds is shown in FIG. **7**. As shown in FIG. **7**, antenna **40** may have a first feed at antenna port P1 that is coupled to transmission line **92-1** and a second feed at antenna port P2 that is coupled to transmission line **92-2**. The first antenna feed may have a first ground feed terminal coupled to ground **112** and a first positive feed terminal **98**-P**1** coupled to patch antenna resonating element **110**. The second antenna feed may have a second ground feed terminal coupled to ground **112** and a second positive feed terminal **98**-P**2**.

[0040] Patch **110** may have a rectangular shape with a pair of longer edges running parallel to dimension X and a pair of perpendicular shorter edges running parallel to dimension Y. The dimension of patch **110** in dimension X is L1 and the dimension of patch **110** in dimension Y is L2. With this configuration, antenna **40** may be characterized by orthogonal polarizations and multiple frequencies of operation.

[0041] When using the first antenna feed associated with port P1, antenna **40** may transmit and/or receive antenna signals in a first communications band at a first frequency (e.g., a frequency at which a half of a wavelength is equal to dimension L1). These signals may have a first polarization (e.g., the electric field E1 of antenna signals **116** associated with port P1 may be oriented parallel to dimension X). When using the antenna feed associated with port P2, antenna **40** may transmit and/or receive antenna signals in a second communications band at a second frequency (e.g., a frequency at which a half of a wavelength is equal to dimension L2). These signals may have a second polarization (e.g., the electric field E2 of antenna signals **116** associated with port P2 may be oriented parallel to dimension Y so that the polarizations associated with ports P1 and P2 are orthogonal to each other). During wireless power transfer operations and/or wireless communications using system **10**, device **10**A and/or device **10**B may use one or more antennas such dual-polarization patch antenna **40** of FIG. **7** and may use port P1, port P2, or both port P1 and P2 of each of these antennas. When patch antenna **40** exhibits two orthogonal polarizations, it may be desirable to use an antenna formed from a pair of crossed dipoles (sometimes referred to as a crossed dipole antenna) on one end of path **106** and the patch antenna on the other end of path **106**.

[0042] In scenarios in which patch **110** has different X and Y dimensions, antenna **40** will exhibit resonances at different frequencies (i.e., antenna **40** will serve as a dual-polarization dual-frequency patch antenna). Dual-polarization dual-frequency patch antennas, crossed dipoles, or other antennas may be used in multiple-antenna arrays (in device **10**A and/or device **10**B). For example, device **10**A and/or device **10**B may have an array of antennas **40** that are used in a beam steering arrangement for wireless charging (e.g., wireless charging at 2.4 GHz or other microwave frequencies) or for wireless communications (e.g., millimeter wave communications at 60 GHz such as WiGig communications or communications at other suitable communications frequencies). Dual-polarization dual-frequency patch antennas may be used on one end of path **106** (e.g., in device **10**A) or on both ends of path **106** (e.g., in device **10**A and **10**B).

[0043] In the example of FIG. **7**, patch element **110** has a rectangular shape with dimensions (length and width) L1 and L2. If desired, patch element **110** may be square (e.g., L1 and L2 may be equal so that patch **110** exhibits a resonance in a communications band at a single frequency) or may have other patch shapes (e.g., shapes with straight edges, curved edges, combinations of straight and curved edges, etc.). In the illustrative configuration of FIG. **8**, patch antenna **40** has an oval shape and is associated with two feeds: a first feed having positive antenna feed terminal **98**-P1 and a second feed having positive antenna feed **98**-P2.